Life History, Ecology, and Management of the Alewife

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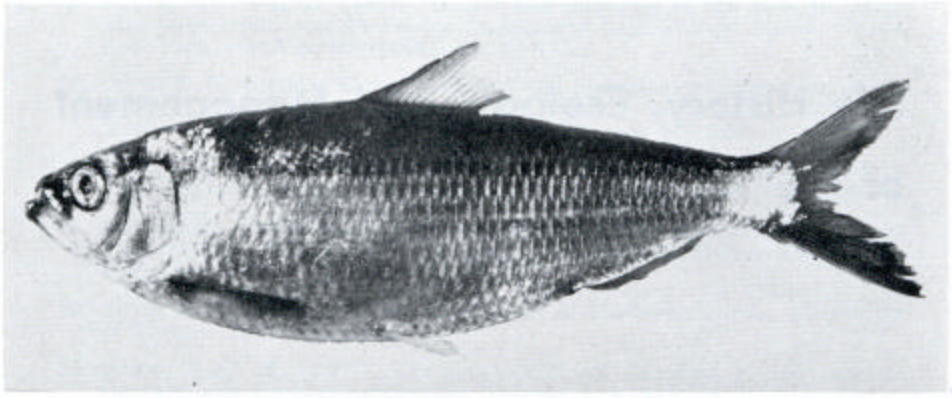
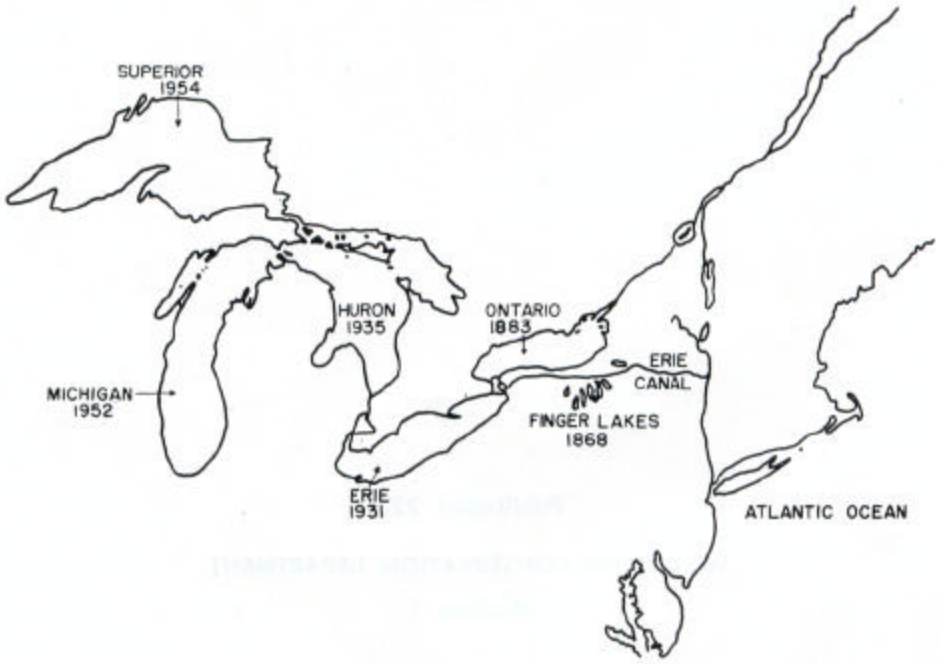


Profile photograph of an alewife captured in Lake Michigan.



Outline map of the Atlantic coast and the Great Lakes drainage, with dates of invasion by the alewife.

LIFE HISTORY, ECOLOGY, AND MANAGEMENT OF THE ALEWIFE

(Pomolobus pseudoharengus Wilson)

By C. W. Threinen

SPECIES

The alewife is a member of the herring family (*Clupeidae*). Among its relatives are the shad (*Alosa sapidissima*) in salt water and the gizzard shad (*Dorosoma cepedianum*) in fresh water. This species is also known as the sawbelly, particularly among commercial fishermen, and on the East Coast where it ascends streams to spawn it may be called the branch or river herring, and spring herring.

DISTRIBUTION

Before settlement of the country the alewife was confined to the Atlantic Coast, spending most of its life in salt water and spawning in fresh. Since settlement, altered drainage routes and indiscriminate stocking have led to extension of its range into fresh water. It became established in the Finger Lakes of New York about 1868, in Lake Ontario[1] in 1883, Lake Erie in 1931, Lake Huron in 1935, and Lake Michigan[2] in 1952, and it was first reported for Lake Superior in 1954. Extension of the range into the upper Great Lakes has been linked with high waters which allowed easier passage up locks and rivers. Wisconsin fishermen will see increasing numbers of this fish since it has already (1957) become abundant in Lake Michigan. Some inland lakes in Quebec have also acquired populations of alewife, but the species has not become a resident of the Maine fresh-water lakes although it spawns in some of them.

DESCRIPTION

The alewife like other herring has soft fins, lacks teeth, has no adipose fin, and has a forked tail. This species is characterized by a knife-edge belly and a saw-like arrangement of scales on the edge, hence the name sawbelly. This herring can be distinquished from its near relatives by its relatively heavy build forward, thin body, its big eyes and a short upper jaw and projecting lower jaw. The body is about 3½ times as long as it is deep. Color of the back is a grey-green or brownish green which becomes a bright silvery color on the sides and belly. The cheek is also silvery. The larvae are transparent, have large eyes, and black pigment cells along the ventral portion of body.

The freshwater alewife has been found to have a slightly larger head than the salt water form. An Ontario author (Graham 1956) concluded that this was the result of differential selection, the large headed fish having a greater number of chloride secreting cells in their gills to maintain osmotic balance.

REPRODUCTION

When making its home in salt water, the alewife ascends fresh streams during daylight to spawn in ponds and in sluggish stretches of streams. In earlier descriptions of the spawning act for salt water forms a single female was accompanied by six to seven males as the heavier-than-water adhesive eggs are deposited over sand, gravel or rubble

[1] There is some dispute on the origin of the Lake Ontario alewife. Toner (1934) said the presence of alewife above the falls in Frontenac and Leeds counties (eastern Ontario) disproves the claim of introduction.

[2] Miller (1957) reports the first specimen from Lake Michigan was captured in 1949.

bottom. More recent observations on Lake Ontario report the alewife spawning at night in groups of three or in pairs. The spawning occurs when water temperatures are 55–60° Fahrenheit, and it has been observed from March to July. The freshwater alewife loses its migratory habits, and to spawn, the fish moves into shallow water laying its eggs on sand or gravel bottoms. Large schools of ripe fish have been observed in the warm condenser cooling waste waters of a power plant on Lake Michigan. In the Finger Lakes of New York spawning has been observed from late May to early August. Much swirling and splashing accompanies the spawning act. Mature females seven inches long from freshwater Seneca Lake, contained 10–12,000 eggs. The more fecund salt water form deposits 60,000 to 100,000 eggs. Eggs kept at 56–60° in running water, and 60–74° F. in standing water hatched in 81–132 hours. In the laboratory hatching began in two days and was complete at the end of six days at a 60 degree water temperature and the yolk sac is absorbed within 4–5 days. The salt water dwelling adults return to salt water soon after spawning, and the young migrate to salt water throughout the latter part of the summer when they are 2–4 inches long. In freshwater the young remain around the spawning grounds until the late larval stage is reached.

HABITS AND HABITAT

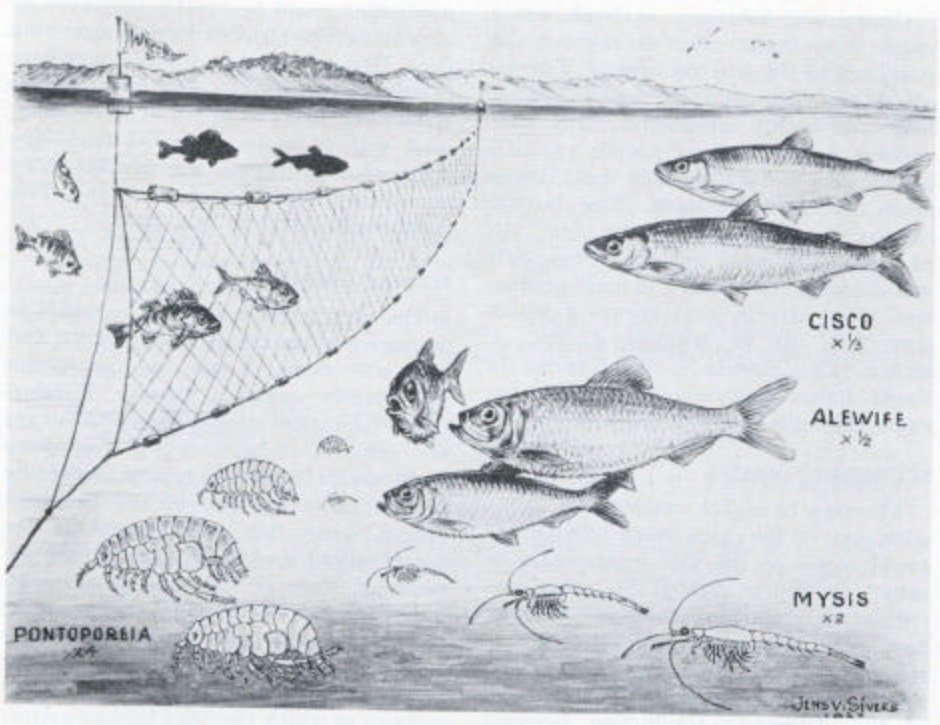
Alewives are essentially a pelagic and gregarious fish. In the ocean, schools as large as 40,000 fish have been observed. In Lake Michigan schools of spawning fish were thought to number 5–6,000 individuals in schools 15–20 feet in diameter. While on their in-shore migration they come into shallow water at night and remain off-shore during the day. In late August they migrate to deep water. Test netting in the Finger Lakes yielded alewives at all depths down to 160 feet. Test netting in Lake Ontario revealed that alewives were most abundant between 30 (180 feet) to 50 (300 feet) fathoms. The fry are both phototrophic and pelagic. Following spawning, some mortality of adults has been observed among the ocean migrants. Lake Ontario populations have been periodically subjected to large summer die-offs when the adults enter shallow water. This phenomenon has been correlated with water temperature changes, the alewife being unable to adjust to the 10° C. (50° F.) temperature gradient between deep and shoal water. The alewife is characterized as being unable to adjust to rapidly rising or fluctuating temperatures. It is also a fragile fish which will not stand much handling.

FOOD HABITS

Foods of the alewife are chiefly animal planktonic organisms. Seneca Lake, New York studies found 46 percent of the volume of stomach contents were microcrustacea. Twenty-four specimens captured in Lake Ontario had eaten mostly *Mysis relicta*, an opossum shrimp inhabiting deep water, and some *Pontoporeia*, a deep water scud. The New York study concludes that alewives rarely take fish, eat chiefly animal plankton and take other food if available. The salt water residents cease feeding when they ascend fresh water streams to spawn.

GROWTH

The growth of the alewife is much better in salt water than in fresh. Ocean residents will attain a length of 15 inches, but the average size is 10–11 inches and 8–9 ounces. In fresh water alewives seldom exceed 8.5 inches, and the average length is about 6 inches. Specimens from Lake Ontario were 3.5 inches total length at the age of one year, 5.3 inches, at two, 6.4 at three, 6.7 at four, 7.2 at five, and at six 8.5 inches. A three-year old specimen coming from salt water would be 10.8 inches. The females have a longer life span and may become about an inch longer than males. Wisconsin commercial fishermen report that it takes 12–13 fish to make a pound. Apparently few alewives live beyond 5 or 6 years.



The alewife feeds primarily on plankton, is food for the lake trout, and is a nuisance to perch gill-netters.

Maturity for the salt water form occurs at three years of age in the southern part of its range and four years in the north. In Lake Ontario mature males are 108.6 mm (4.2 inches standard length) and have two annuli; mature females are 125.4 mm, (4.9 inches standard length) and have 3 annuli.

ECOLOGY

Freshwater alewives, being pelagic and planktonic feeders, compete with the ciscos, particularly deep water species, according to Stone (1947) and shallow water species (Graham, 1956). A decline in the shallow water cisco (herring) has paralleled an increase in the number of alewives in South Bay (Lake Huron) Saginaw Bay (Lake Huron) and Green Bay (Lake Michigan). They are, however, excellent forage for lake trout and burbot, particularly in summer. Since the young remain in-shore through the summer, they are, no doubt, an important food for in-shore species such as perch, walleye, and smallmouth bass. Similarly, they are said to be an important food supply for ocean predators. The rapid build-up of alewife in the Great Lakes is thought to be the result of the disturbed inter-relationships between species caused by the sea lamprey.

ANGLING AND COMMERCIAL FISHING

The species is seldom angled in fresh water because of its small size and poor eating qualities. Some have been taken with artificial flies in the ocean, and on occasion when schooling tightly they can be caught on small spoons and wobblers in fresh water. They are quite active and can provide some sport on light tackle.

Commercial fishermen in fresh water catch them in gill nets throughout the year, and in the Algoma area of Wisconsin during the spawning season pound nets are highly productive. Gill nets average a few hundred pounds per lift, pound nets 6–8,000 pounds daily to as much as 12,000 pounds. The largest catches occur between the 1st and 15th of June, the peak of spawning. Salt water commercial fishing is most productive when stream runs occur at which time they can be trapped, dipped, or seined. The alewife is troublesome to Great Lakes commercial fishermen because they gill easily in perch nets.

ECONOMIC VALUE

Alewives have low commercial value, with most of the catch going into animal foods. Some of the salt water catch is salted, smoked or pickled like other species of herring, and some are used as bait. The greasy flesh lends itself to smoking, but the thin body and many small bones detract from its value. Most of the Wisconsin production becomes mink food. Eastern fish hatcheries have used alewives as trout food for which it has proven quite satisfactory. The state of New York has often sent crews to Lake Ontario to take this easily procured hatchery trout food resource. Analyses show that the flesh is 49.5 percent refuse (presumably entrails), 37.5 percent water, 9.7 percent protein and 2.8 percent fat. Nutritional value is 285 calories per pound.

Present total production for the Great Lakes is not a matter of record since the species is not reported separately. Oceanic U. S. production was 52,225,000 pounds in 1954. It is estimated that production could be greatly increased by improving the streams having spawning runs. Historically the alewives have been extremely important. They provided the struggling first colonists of New England with a ready source of food. The right of free fishing and fowling grew out of the need to catch these fish. This right carries over to this day.

MANAGEMENT

The alewife of salt water responds to management measures. Dams of 2.5 feet high will impede a run, but the species will readily ascend a fishway. Elimination of pollution, construction of fishways and removal of barriers and restocking could double Maine production, according to one estimate. One of the problems facing ocean fish management is the decentralized control of this fishing. Instead of state or national government, towns control the fisheries, and scientific control, to allow the necessary escapement, is impossible. Stocking of mature adults has re-established runs in many streams in which they had become extinct because of pollution or damming.

In fresh water where they are regarded as more of a competitor with desirable species, intensive fishing and satisfactory markets are more important management measures. Fortunately, alewives are easily caught in great numbers when they enter shallow waters in early summer. Management should encourage harvest, and formation of steady markets. Since the alewife can apparently adapt itself to large inland lakes such as the Finger Lakes of New York, its transportation alive to other waters than those in which it is established should be prohibited.

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